METHOD FOR FORMING A CAP WITHOUT DRAFT ALLOWANCE FOR A PNEUMATIC GUN

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a method, and more particularly to a method for forming a cap without any draft allowance during a die casting process.

2. Description of Related Art

A cap is always mounted on a pneumatic gun to define an air chamber for the piston of the pneumatic gun. To achieve a good precision in size, the cap is always formed with the cold chamber method of a die casting process. A metal mold is used to form the cap and has an impression with a shape substantially equal to that of the cap and defined in the mold. To conveniently take the cap out from the mold, draft allowances are previously set in the impression of the metal mold.

However, oblique faces are formed in the cap due to the draft allowances in the mold. After the cap is formed with the die casting process, the unnecessary portion formed by the draft allowances must be cut off. An additional task must be performed on the cap, such that the processes for forming the cap for a pneumatic gun are troublesome and the cost for manufacturing the cap is high.

To overcome the shortcomings, the present invention tends to provide a method for forming a cap without draft allowance to mitigate and obviate the aforementioned problems.

SUMMARY OF THE INVENTION

The main objective of the invention is to provide a method for forming a cap without draft allowances during the die casting process. The method has the steps of

forming a metal mold with a specific scale, feeding molten material at a desired temperature into the cylinder, injecting the molten material into the impression at a specific speed, and cooling the molten material to solidify. With such a method, a cap without draft allowance is formed, such that the process for forming the cap is simplified and the cost for manufacturing the cap is reduced.

Other objects, advantages and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a cross sectional side plan view of a cap formed with a method in accordance with the present invention; and

Fig. 2 is a side plan view in partial cross section of a metal mold for forming the cap in Fig. 1.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

With reference to Fig. 1, a cap (30) for a pneumatic gun in accordance with the present invention comprises a body with a closed first end wall and a second end wall. An opening is defined in the second end wall of the body and has a floor parallel to an edge of the second end wall of the body. An annular flange (31) perpendicularly extends from the floor in the opening. No draft allowance is arranged in the cap (30) as will be described in more detail later.

To form the cap (30) without draft allowances, with reference to Figs. 1 and 2, a metal mold constructed of a female portion (10), a male portion (20) and a cylinder (11) is provided. An impression (100) with a shape substantially equal to that of the cap (30) is defined between the portions (10,20). Multiple cooling channels (13) are defined in

the portions halves (10,20) and extend around the impression (100). The portions (10,20) are selectively made of SKD 61 alloy tool steel. The hardness of the portions (10,20) is in a range H_{RC} 45 to 50. A heat treatment must be applied to the surface of the portions (10,20) to increase the hardness of the surface of the portions (10,20) to H_{RC} 70 with a depth 0.25 mm (millimeter). The smoothness of the surface of the portions (10,20) is 800μ.

The cylinder (11) is connected to one of the portions (10,20) and is communicated with the impression (100) through an injecting passage (102). A piston (12) is moveably mounted in the cylinder (11) to force molten material such as Aluminium into the impression (100). The preferred temperature of the molten Aluminum is 650 to 680 ℃. A sprue (110) is defined in the cylinder (11) for the molten material to be fed into the cylinder (11).

To inject the molten material into the impression (100), the piston (12) presses the molten material into the injecting passage (102) at a low speed 1.5 m/s (meters per second) firstly to avoid the air of the environment from being sucked into the cylinder (11) through the sprue (110). The molten material is then forced into the impression (100) at a speed 4.5 m/s. The air in the impression (100) will be forced into an air chamber (101) communicating with the impression (100). In practice, the air chamber (101) is connected to an air pump (not shown) to exhaust the air from the impression (100) and the air chamber (101), such that this can avoid gas bubbles forming in the cap (30). The pressure provided by the piston (12) to the molten material is increased to 220kg/ cm^2 so that the density of the molten material is increased. The molten material is cooled to between 180 and 200 ℃ in 20 to 25 seconds due to cool water passing along the cooling channels, whereby the molten material solidifies as the cap (30). When the cap (30) has

cooled and its volume decreased in comparison to its hot state, a gap will be defined between the cap (30) and the inner surface of the impression (100) due to the contraction of the cap (30). The gap can help the cap (30) to be ejected from the mold without draft allowance. Thus, the cap (30) can be directly mounted on a pneumatic gun without any additional work. Accordingly, the process for manufacturing the cap (30) is simple, and the cost for manufacturing the cap (30) is low. In addition, multiple pins (21) are mounted in the mold to push the cap (30) to release it from the mold.

In addition, to improve the convenience of releasing the cap (30) from the mold, an isolating agent is previously sprayed onto the inner surface of the impression (100) before the die casting process is undertaken. The agent is a mixture of 10% ester, 4% vegetable oil, 6% silicon oil, 1% polymer and 79% water. The agent is diluted with water at a ratio 1:120 when the agent is used.

Even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the disclosure is illustrative only, and changes may be made in detail, especially in matters of shape, size, and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.